

KARL WEIERSTRASS.

THE death of Prof. Karl Weierstrass, on February 19 in the present year, has taken from science one of the greatest pure mathematicians of the century. It is now some considerable time since he ceased to deliver lectures as professor in the University of Berlin; the last few years of his life were troubled by broken health. As is indicated by a pathetic reference in the preface to the first volume of his Collected Works, he was obliged to obtain assistance, partly in preparing them for publication, and partly to secure that his intentions with regard to them might be carried out in case of his death. This help was loyally given by friends and former pupils during his life; it may be expected that the same loyalty will now be devoted to completing the series, which will be a fitting monument to his genius. And the appearance of the successive volumes will be eagerly expected and cordially welcomed by pure mathematicians all the world over.

Weierstrass was born at Osterfelde, near Münster, on October 31, 1815; so that at the time of his death he was in his eighty-second year. His first professorship was at Deutsch Krone, the appointment dating as far back as 1842; from that chair he passed, in 1848, to Braunsberg; and thence to Berlin. He was made professor extraordinary at that University in 1856, and full professor in 1864; after which date the rest of his life was spent in connection with the University.

The long range of his life finds a parallel in the long range of his scientific activity; a couple of facts may suffice in illustration of its now distant beginning. As long ago as 1840, he prepared a memoir on elliptic functions, then called modular functions (it constitutes that portion of his now classical memoir "Theorie der Abelschen Functionen," which relates to elliptic functions): in 1840, Cayley was an undergraduate at Cambridge. Weierstrass's first paper on the higher Abelian transcendental functions was published in 1848; the contributions, which he then made to the theory, and the analytical method, which he then was perfecting, have been of significant import in the algebraical development of the theory of these functions. In 1848, Riemann was a student in Berlin; to the younger generation of mathematicians Riemann seems to belong to the past, for he died more than thirty years ago.

This is not the occasion to write of Weierstrass's work in detail, or to sketch the magnitude of his influence upon science and upon mathematicians. Its appreciation in England was marked by the Royal Society in 1881, when he was elected a foreign member of that body, and again in 1895, when he was awarded the Copley medal—the highest honour which the President and Council have the power to bestow in recognition of scientific worth. It would be idle to surmise what Weierstrass's precise place in the history of his subject may prove to be, and its consideration may fairly be left to the future: any contemporary estimate would make it high and honourable. He has been described as the parent of modern mathematical analysis; his years and his knowledge had made him a Nestor among mathematicians; and those who knew his writings, even though they may not have known the man, will learn of his death with a sense of personal regret.

A. R. F.

NOTES

M. G. DARBOUX, the distinguished professor of higher geometry in the University of Paris, has been elected a corresponding member of the Berlin Academy of Sciences.

THE fifth "James Forrest" lecture of the Institution of Civil Engineers will be delivered by Dr. G. Sims Woodhead on Thursday, March 18, on "Bacteriology."

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A SPECIAL meeting of the Chemical Society is announced for Thursday, March 25, at eight o'clock, when Prof. Percy Frankland, F.R.S., will deliver the Pasteur Memorial lecture.

THE contributions so far sent by members of the General Committee of the British Section of the Pasteur International Memorial, amount to 425*l.* (10,625 francs). This sum has been forwarded to the Central Fund in Paris.

MR. EDGAR THURSTON, Superintendent of the Madras Museum, has just arrived in England on a year's leave of absence.

MR. W. HARCOURT-BATH, who contributes to the March number of *The Entomologist* a suggestive note on the causes of the decadence of the British Rhopalocera, is about to leave England upon an entomological expedition to the Himalayas.

WE regret to announce the deaths of Prof. Georges Ville, professor of botanical physics in the Paris Natural History Museum, and Geheimrath Wilhelm Döllén, formerly assistant in the Observatories of Dorpat and Pulkova, and the author of a number of important papers in geodesy and astronomy.

THE Council of the Society of Arts will proceed to consider the award of the Albert Medal for 1897 early in May next, and they, therefore, invite members of the Society to forward to the Secretary, on or before the 10th of April, the names of such men of high distinction as they may think worthy of this honour. The medal was struck to reward "distinguished merit for promoting Arts, Manufactures, or Commerce," and was last awarded to Prof. D. E. Hughes, F.R.S.

THE Victorian Era Exhibition, to be held this year at Earl's Court, London, S.W., will comprise scientific and economic sections. The object of the exhibition is to show the advances which have been made during the sixty years of the reign of Her Majesty the Queen. In the scientific section it is intended to devote particular attention to the discoveries and inventions made in the United Kingdom during the Victorian era, and their development and application to purposes of general public utility. The chairman of the sub-committee of this section is Major-General Sir John Donnelly, R.E., K.C.B., and the vice-chairman, Mr. W. H. Preece, C.B., F.R.S. There are fifteen other members of the committee, most of them being Fellows of the Royal Society, and all of them known in the scientific world.

THE Mathematical and Physical Section of the Royal Society of Naples announces that the mathematical prize of 1896 is unawarded, and the competition will be postponed till March 31, 1898. The theme for the prize is as follows:—To expound, discuss, and coordinate, possibly in a compendious form, all researches concerning the totality of prime numbers, introducing some noteworthy contribution to the laws according to which these numbers are distributed among integers. The essays may be written in Italian, French, or Latin.

H.S.H. PRINCE ALBERT OF MONACO has just published, in the *Comptes rendus*, the usual summary of his work in the Atlantic and Mediterranean. The third season's cruise includes 82 soundings, with 19 sets of temperature observations; samples of air and water were collected and examined, the former in the open sea and at high altitudes on the Azores. The most interesting result obtained is the discovery of a new bank, christened the Princess Alice Bank, near the Azores, between 31° 28' and 31° 41' N. lat. and 37° 50' and 38° W. long. This bank lies N.W. to S.E., bottom rock and volcanic sand, at a mean depth of 252 metres, and has a rich and abundant fauna. On June 4 to 6, between Monaco and Corsica, hundreds of swallows alighted on the vessel and showed themselves remarkably tame, making their way into the engine-room and stoke-hold, and feeding from the sailors' hands.

M. JULES RICHARD, zoologist on board the Prince of Monaco's vessel, describes in the *Comptes rendus* an apparatus devised by him with the view of ascertaining whether the amount of gases dissolved in sea water is independent of pressure at great depths, or not. A steel bottle filled with mercury, and ingeniously arranged to remain vertically inverted over a beaker, was allowed to slide down the sounding line till, at the required depth, a catch previously attached to the line actuated an arrangement for lowering the beaker slightly, allowing mercury to escape from the bottle and to be replaced by water. A messenger, sent down later, "set off" the reversing thermometer, and at the same time lowered the steel bottle again into the mercury of the beaker. On drawing the whole up, any gases not in solution must have been set free, either by change of temperature or of pressure. The result of two satisfactory experiments at depths of 1000 and 2700 metres is to confirm previous experience that the quantity of gas dissolved is independent of the pressure. M. Richard applies a similar mechanical arrangement to a modification of Giesbrecht's tow-net, which he describes in the *Bulletin de la Société Zoologique de France*. The tow-net is placed on the sounding-line after the latter has been lowered to the desired depth, and allowed to slide down closed, until a stop on the line arrests and opens it. Before hauling up, the mouth of the net is again closed by a messenger let down from the surface. In a series of notes, M. Richard contributes to the same publication observations on a *Limnocythera* of the lakes in the Bois de Boulogne, on the freshwater fauna of the Azores, and on the fauna of some high lakes in the Caucasus, the last from collections by M. Kavraiskiy.

ABUNDANT stores of cleveite, alvite, monazite, and other rare minerals, have been found in a mine recently discovered at Ryfylke, Norway. A specimen of the cleveite has been sent to us, and it proves to be very rich in helium. Many investigators will be glad to know that the minerals can be purchased at a comparatively low price, particulars of which will be found in our advertisement columns.

FROM a careful study of James Glaisher's aerostatical observations, Signor F. Siacci has propounded two new formulæ representing the law of decrease of atmospheric temperature and aqueous vapour with the altitude. From these he has deduced a new barometric formula for the measurement of altitudes, as simple as Laplace's formula, and which, when tested on Monviso and Mount Etna, has given almost perfect results.

AN investigation of certain new series for the Gamma Function has been given by Herr G. Landsberg, of Heidelberg, who has discovered some remarkable generalisations of Stirling's and Kummer's series. The two new series, of which these are particular cases, are shown to be closely connected together, a result the more remarkable in view of the fact that Kummer's series is convergent for certain values of the variable, while Stirling's series is always semi-convergent, being ultimately divergent, though the convergent portion can be used for practical approximations. Herr Landsberg's paper is to be published by the Royal Academy of Belgium among their foreign memoirs.

THE brilliantly iridescent colours of the scales on the Brazilian diamond beetle (*Entimus imperialis*) have been examined by Dr. Garbasso, who finds that, unlike the corresponding colours in Lepidoptera, these are entirely due to interference, and are of the nature of colours of thin plates. With transmitted and reflected light the colours seen are complementary; moreover, the colours can be altered by subjecting the scale to pressure; again, on moistening and subsequently drying the scale, changes of colour are observed not unlike those produced in M. Lippmann's colour-photographs when the gelatine film has been moistened and allowed to dry. All these

phenomena accord with the view that the scales consist of two layers separated by a thin interspace. Dr. Garbasso's paper is published in the *Memorie della R. Accademia delle Scienze di Torino*.

PROF. F. PLATEAU, of the University of Ghent, has for many years carried on a series of observations on the mode in which insects are attracted to flowers, the results of which are published in the *Bulletin* of the Royal Academy of Sciences of Belgium. His conclusions are not in accord with that of Darwin, that the bright colour of the corolla acts as a beacon to attract insects. He believes that they are attracted chiefly by some other sense than that of sight, probably that of smell. In the case of the dahlia (single) and other species of Compositæ, the removal of the conspicuous ray-florets had but little effect on the visits of insects; nor had the removal of the conspicuous part of the corolla in other flowers, as long as the nectary remained. On the other hand, the artificial placing of honey on otherwise scentless flowers resulted in their being immediately visited by numbers of insects. Where the same species varies in the colour of the flower, as between blue and white, or red and white, insects visit quite indifferently flowers of different colours belonging to the same species.

AN interesting paper by Prof. F. Omori, on the intensity and amplitude of the motion in the great Japanese earthquake of 1891, appears in the latest *Bollettino* (vol. ii. N. 6) of the Italian Seismological Society. At Osaka, distant 140 km. from the place where the shock was most severe, the maximum horizontal displacement (or double amplitude) was 30 mm., and the maximum acceleration, which measures the intensity, 600 mm. per sec. per sec. At Tōkiō, distant 270 km., the displacement was about 45 mm., and the maximum acceleration 230 mm. per sec. per sec. These values were obtained from seismographic records. Nearer the epicentre, the maximum acceleration can only be determined by observations on the overturning or fracturing of various bodies. At two places in the province of Owari, it exceeded 4300 mm. per sec. per sec.; while at Nagoya, in the same province, it was found to be 2600 mm. per second, and the greatest displacement 220 mm.

IN the January number of *Natur und Offenbarung* (Münster), Dr. J. W. van Bebbler gives an interesting account of the methods employed and the success attained in the telegraphic weather service of the Deutsche Seewarte at Hamburg, and traces the history of this branch of meteorological science since the invention of the optical telegraph in 1793. The question of the actual results attained is not so easy to decide as might at first sight appear, owing to the various methods employed in checking them, and the different purposes for which the forecasts are used. Seamen are mostly concerned with the direction and force of wind, while agriculturists are chiefly interested with temperature, and fine or wet weather. In the present state of the science, the former conditions are much easier to predict than the latter. So far as storm warnings are concerned, the author has investigated the cases in which shipping casualties have occurred on the German coasts for a considerable number of years, and finds that in nearly all cases successful warnings were issued. The methods employed are nearly similar to those followed in this country; telegrams are received at various hours showing, according to the international code, the actual conditions, and the changes since the previous reports. In the morning five weather charts are simultaneously prepared, showing respectively the barometric pressure, wind direction and force, state of the sky, temperature, and rainfall, &c. In the afternoon two charts are drawn, showing the air-pressure, temperature, and the variations since the morning, and during the unsettled season (September to April) further charts are constructed, showing the conditions in the evening.

THE current number of the *Revue de l'Université de Bruxelles* contains an interesting memoir by Dr. Funck, entitled "Les vaccinations contre le choléra aux Indes." It will be remembered that the first attempts at anti-cholera vaccination originated with and were carried out by a Spanish medical man, Dr. Ferran, some twelve years ago, and we can but admire the splendid audacity which in those early days led him to practise inoculations with living cholera bacilli. His vaccine consisted of eight drops of a cholera culture mixed with bile, and the misfortunes which followed his inoculations were, probably, largely attributable to his cholera cultures not being pure. That considerable faith was in the first instance placed in Ferran's process, is shown by the fact that some 25,000 persons underwent the treatment. Haffkine's vaccinations against cholera are a direct outcome of the pioneering work published by Ferran on this subject in 1885. In the inoculations which have proved so successful in India, Haffkine employs first, attenuated cholera bacilli, and then, a few days later, virulent cholera cultures; but recently Kolle has obtained equally good results by using dead cholera bacilli, which have been destroyed either by heat or chloroform. In the latter process rather larger doses have to be employed to produce the same effect. The blood of persons vaccinated against cholera has been tested as to its protective potency, and it has been found to be two hundred times more active against cholera infection than that of a non-vaccinated individual. That improved sanitation and enlightened hygienic measures are capable of combating cholera to a most important extent, is shown by the fact that, since the year 1892, whilst in Russia 800,000 individuals have fallen victims to cholera; in Germany, including the Hamburg cholera epidemic, only 9000 cholera deaths have been recorded.

A DESCRIPTIVE list of all published observations of the Aurora Australis is given by Dr. Wilhelm Boller in Gerland's "Beiträge zur Geophysik" (vol. iii.). From this catalogue it appears that the greatest number of observations were made in March and October, and the least in June and November. As with the Aurora Borealis, the frequency of the phenomena seems to vary in consonance with the eleven-year period of solar activity. The line which embraces all the observations is a circle around the south magnetic pole, this result being similar to that obtained by Nordenskiöld from the observations of the Aurora Borealis. Dr. Boller intends to amplify and continue his catalogue, and for that purpose he will be glad to know of any records overlooked by him, or of any observations which may be made in the future. Letters will find him at the Geographical Seminary of the University of Strasburg.

EVIDENCE of the former extension of glacial action on the west coast of Greenland, and in Labrador and Baffin Land, is given by Mr. George H. Barton in the *American Geologist* (December 1896), an excerpt from which has just been sent to us. Mr. Barton went to northern Greenland with the sixth Peary expedition in the summer of last year, and he proposes to continue his observations during the coming summer, when Lieut. Peary will take another expedition to Greenland for the purpose of obtaining the large meteorite which could not be shipped last year. The coast of Greenland offers exceptional facilities for the study of glacial phenomena. It is hoped, therefore, that, as Cornell University and the Massachusetts Institute of Technology sent parties with the Peary expedition last year, other universities, colleges, and scientific organisations will send parties to accompany the forthcoming expedition.

AN interesting contribution to the question "How do igneous rocks intrude?" has been made by Prof. I. C. Russell, in two papers to the *Journal of Geology*, and one to the *Popular Science Monthly* (December 1896). Besides bringing together a number

of suggestions already made, he introduces some new ideas based on his study of the Black Hills of Dakota. In that region a number of structures are found (of which striking photographs are given), resembling the famous laccolites of the Henry Mountains, but, in part, differing from them in the absence of any lateral extension. These Prof. Russell calls *plutonic plugs*. A study of these leads him to the suggestion that the whole of the Black Hills uplift, and other mountain uplifts in which direct elevation and stretching take the place of compression and crumpling, may be due to enormous laccolite-like intrusions of molten rock at a great depth. Such an intrusion he terms a *subtuberant mountain*, and suggests that crystalline areas, commonly said to show "regional metamorphism," may be such subtuberant mountains laid bare.

OUR congratulations to the Leicester Literary and Philosophical Society. Stimulated into action by a paper on the disappearances of certain species of insects, by Mr. Frank Bouskell, a Committee was formed to formulate regulations for the protection of local species. As a result of their deliberations, a list of insects has been drawn up, and the number of each allowed to be taken by members of the Society in one season has been specified. When a collector now sees *Leucophasia sinopsis* (the Wood White butterfly), he must hold his hand and crush his sporting instinct, for none of this insect are to be taken. Of *Macroglossa fuciformis* only one specimen must be taken by each member in a single season, and only one specimen of *Sesia apiformis*. The penalty for breaking these regulations are drastic. If a member of the Society, the transgressor is liable to be expelled by a bare majority of the members present at any meeting, and if a member of any other Society, the transgression will be reported to that Society. Landowners will also be asked to refuse to permit offenders to pass through their grounds. The over-zealous collector will, indeed, be ostracised, and will find that no one will buy from him, exchange with him, or have anything to do with him entomologically. There may be a difficulty in carrying out the regulations, and one result will probably be that collectors will prefer to go out alone in the future. But it is hoped that entomologists will remember that they are not supposed merely to fulfil the functions of a fly-paper, but also to work for the advancement of their science.

LECTURERS upon geography will be glad to know that lantern slides of the illustrations in Dr. Nansen's "Farthest North" are now published by Messrs. Newton and Co., who made the slides which Dr. Nansen uses at his own lectures.

AN elaborate descriptive catalogue of chemical apparatus, containing more than five hundred pages, has been issued by Messrs. A. Gallenkamp and Co. The list contains quotations for apparatus and accessories used in every branch of chemistry, and the prices are given both for Germany and the United Kingdom.

The *Rendiconti del R. Istituto Lombardo* (xxx. iii.) contains papers, by G. Melzi, "On Certain Rocks from the Island of Ceylon," and an account, by Prof. C. Somigliana, of some determinations of the specific heat of sea and lake water, undertaken by the late Prof. Adolfo Bartoli, of Pavia, shortly before his death, and forming his last contributions to science.

THE March number of the *Geographical Journal* contains a fine portrait of Dr. Nansen, reproduced by the Swan Electric Engraving Company, and an illustration of the special medal presented to him by the Royal Geographical Society. The address delivered in the Albert Hall, on February 8, is not printed in the *Journal*, because Dr. Nansen is delivering it in

different parts of the United Kingdom during the present month.

Two parts recently issued complete the ninth volume of that useful publication, *The Essex Naturalist*. A more than local interest attaches to the reports on the borings for coal at Stutton and Weeley, on the latter of which more details are promised in the next number. Both borings have been unsuccessful in their primary object, high-dipping unfossiliferous rocks, of at least Lower Carboniferous age, coming immediately under the Gault in both cases. Among the numerous papers and notes on Essex matters, we note a contour-shaded map of South Essex, prepared by Mr. T. V. Holmes, which may be regarded as an example of how accurate small-scale maps can be produced: it is reduced by photography from a shaded six-inch map.

THE well-known work on "Metals; their properties and treatment," published in Messrs. Longmans' series of Text-Books of Science, has been considerably enlarged by Prof. A. K. Huntington and Mr. W. G. McMillan. The work originally appeared in 1872, and occupied 312 pages; but, in order to include the great developments which have taken place in the practice of metallurgy in recent years, it has had to be extended to 562 pages, and even now Prof. Huntington regrets that he has not been able to deal with each branch of the subject fully enough to satisfy himself. Notwithstanding this statute of limitations, the new edition of "Metals" has been brought up to date so satisfactorily that it will certainly meet with a hearty reception. The object of the book is to "make clear the principles which have guided the evolution of the metallurgical arts and industries, avoiding multiplicity of detail, which tends to obscure main issues." The present edition of the book shows that this object has been borne in mind throughout, the result being a readable and instructive volume.

THE report drawn up by Prof. W. A. Herdman and Mr. Andrew Scott, on the investigations carried on, in 1896, in connection with the Lancashire Sea-Fisheries Laboratory at University College, Liverpool, contains many noteworthy matters. Particular attention is given to the description of work on oysters and their possible connection with disease in man. Prof. Herdman urges moderation on the part of those sanitary reformers who expect the conditions in which oysters are kept to be perfect. "After all," he says, "we do not want—even if we could get it—an aseptic oyster. The rest of our food—our milk, our bread and cheese, our ham sandwiches, and so on—are teeming with germs, most of them harmless so far as we know; but some of them may be just as bad as any that can be in shellfish. If we were to insist on breathing filtered air, and eating nothing but sterile food, washed down with antiseptic drinks, we should probably die of starvation, or something worse, if we did not go mad first with the constant anxiety." It is held that the object should be to get our oyster-beds as healthy as possible, but not to insist upon conditions which will make it impossible to rear any oysters at all. As the result of work carried out with Prof. Boyce, Prof. Herdman recommends that all grounds upon which shellfish are grown or bedded should be inspected, so as to ensure their practical freedom from sewage, and also that oysters should be kept alive for a short time in running water; for experiments show that the living animal soon gets rid of any disease germs with which it may be infected, if it is kept in clean water. A catalogue of the Fisheries Collection in the Zoological Department of the University College, Liverpool, is appended to Prof. Herdman's report.

Two papers, extracted from the thirteenth annual report of the Bureau of Ethnology, have come to us from Mr. Cosmos Min-

deleff. One is on the "Casa Grande Ruin," situated near Gila River, in Southern Arizona, and the best-known specimen of aboriginal architecture in the United States. The accurate plans and careful descriptions contained in this paper should be very valuable to students of American antiquities. It is concluded that the Casa Grande was undoubtedly built and occupied by a branch of the Pueblo race, or by an allied people. These people were probably the ancestors of the present Pima Indians, now found in the vicinity, and known to be a pueblo-building tribe. The subject of Mr. Cosmos Mindeleff's second memoir is "Aboriginal Remains in Verde Valley, Arizona." It is concluded that these ruins represent a comparatively late period in the history of the Pueblo tribes. There is no essential difference, other than those due to immediate environment, between the architecture of the lower Verde region and that of the more primitive types—Tusayan, for example—found in other regions. The Verde architecture is, however, of a more purely aboriginal type than that of any modern pueblo, and the absence of introduced or foreign ideas is its chief characteristic. The remains suggest that cave lodges and cliff-dwellings are simple varieties of the same phase of life, and that life was an agricultural one. Mr. Mindeleff's paper is a very valuable contribution to the knowledge concerning the interesting archaeological remains of the Rio Verde valley, and their position among types of house structure.

THE fourth Annual Report of the Shanghai Meteorological Society contains an interesting essay on the variations of the atmospheric pressure over Siberia and Eastern Asia during the months of January and February 1890, by the Rev. S. Chevalier, S.J., Director of the Zi-ka-wei Observatory, and President of the Society. The investigation was undertaken to elucidate some of the more doubtful points relating to winter storms in the Eastern seas, and for this purpose synoptic charts have been drawn twice daily for the period in question, showing the distribution of barometric pressure over Siberia and Eastern Asia, based chiefly upon the reports issued by the Russian, Chinese and Japanese services. The conclusions arrived at show that while some of the cyclonic storms may make a tour of the globe, most of them experience great difficulty in crossing Western Siberia, and are generally deflected towards the North Pole by the high pressure prevailing over Central Siberia. The depressions over Siberia, though far distant from the coasts of China, affect, at least indirectly, the weather of those parts; and the author finds that the winter storms of China are very generally preceded by the passage of extra-tropical cyclones. The violence of the gales not only depends upon the depth of the disturbance, but also upon the character of the high-pressure areas in the rear of the depression.

THE additions to the Zoological Society's Gardens during the past week include a Yellow-bellied Liothrix (*Liothrix luteus*) from India, presented by Madame Caté; a Viperine Snake (*Tropidonotus viperinus*), Europe, presented by Mr. J. H. M. Furse; eleven Scorpion Mud Terrapins (*Cinosternon scorpioides*) from North Brazil, presented by Dr. Émil A. Goeldi; a Yellow-cheeked Amazon (*Chrysotis autumnalis*) from Honduras, presented by Mrs. Annie Kattengell; two Chipping Squirrels (*Tamias striatus*) from North America, deposited; a Common Otter (*Lutra vulgaris*) from Berkshire, a Salle's Amazon (*Chrysotis ventralis*) from St. Domingo, purchased; two Egyptian Jerboas (*Dipus aegyptius*), nine Egyptian Cobras (*Naja haje*), two Cerastes Vipers (*Cerastes cornutus*), twelve Egyptian Eryx (*Eryx jaculus*), a Clifford's Snake (*Zamenis diadema*), two Hissing Sand Snakes (*Psammophis sibilans*), two — Snakes (*Zamenis florulentus*) from Egypt, received in exchange.